IN THE CLAIMS

1. (Currently Amended) A method of estimating carrier frequency offset error in a received sample bit stream including an observation vector (OV), having an observed carrier frequency timing offset ε, and a plurality of data-symbol frames, having a symbol timing ~~offset~~ error ϑ, comprising the steps of:

generating a probability density function (PDF) based on an extension portion and a synchronization portion of said OV, the PDF including first and second terms based on said symbol timing error ϑ; and

generating from said PDF an estimate of carrier frequency offset error, $\varepsilon_{MVU|\vartheta}$, being a minimum variance unbiased (MVU) estimator.

2. (Currently Amended) The ~~MVU carrier frequency offset error estimation~~ method of claim 1 wherein said ~~OV~~ extension portion comprises an L-bit cyclic extension portion and said synchronization portion comprises ~~a~~ first and ~~a~~ second N-bit synchronization frames, and wherein ~~said PDF comprises a~~the first term, p1, based on said symbol timing ~~offset~~ error ϑ being within the span 1 to N and ~~a~~ the second term, p2, based on said symbol timing ~~offset~~ error ϑ being within the span N+1 to N+L.

3. (Currently Amended) The ~~MVU carrier frequency offset error estimation~~ method of claim 2 wherein said ~~received~~ bit stream has uncorrelated independent identically distributed random signal and noise sequence variables with power of σ_s^2 and σ_n^2, respectively, wherein said OV is denoted x, and wherein said MVU estimator $\varepsilon_{MVU|\vartheta}$ is the conditional expectation of a second moment estimator, said second moment estimator given by

$$\breve{\varepsilon} = \frac{\Im}{2\pi}\ln\left\{\frac{1}{L\sigma_S^2}\sum_{k=\upsilon}^{\vartheta+L-1} x[k]x^*[k+N]\right\}.$$

4. (Currently Amended) The ~~MVU carrier frequency offset error estimation~~ method of claim 3 wherein said MVU estimator $\varepsilon_{MVU|\vartheta}$ is given by

$$\breve{\varepsilon}_{MVU|\vartheta} = E\left(\breve{\varepsilon}\middle|\,\Pi(\chi,\vartheta)\right) = \frac{\Im}{2\pi}\ln E\left\{\frac{1}{L\sigma_S^2}\sum_{k=\vartheta}^{\vartheta+L-1} x[k]x^*[k+N]\,\Pi(\chi,\vartheta)\right\}$$

$$= \frac{1}{2\pi}\Im\left\{\ln\frac{T_1(\chi,\vartheta)}{L\sigma_s^2}\right\}$$

where $\Im$ is ~~the~~ an imaginary operator and where

$$T_{1(\chi,\vartheta))} = \begin{cases} \sum_{k=\vartheta}^{L+\vartheta-1} x[k]x^*[k+N] & 1 \le \vartheta \le N \\ \sum_{k=0}^{\vartheta-N-1} x[k]x^*[k+N] + \sum_{k=\vartheta}^{N+L-1} x[k]x^*[k+N] & N+1 \le \vartheta \le N+L \end{cases}$$

5. (Currently Amended) A method of synchronizing a ~~received sample~~ bit stream, comprising the steps of:

~~transmitting at a transmitter said bit stream including an observation vector (OV);~~

~~receiving and~~ sampling, at a receiver, said bit stream, said sampled bit stream including i) an observation vector (OV)~~, said OV~~ ~~with~~ having an observed carrier frequency offset ε, and ii) a plurality of data-symbol frames~~,~~ having a symbol timing ~~offset~~ error ϑ;

generating a probability density function (PDF) based on an extension portion and a synchronization portion of said OV, the PDF including first and second terms based on said symbol timing error ϑ;

generating from said PDF an estimate of carrier frequency offset error, $\varepsilon_{MVU|\vartheta}$, being a minimum variance unbiased (MVU) estimator; and

synchronizing said ~~received~~ bit stream by said MVU estimate of carrier frequency offset.

6. (Currently Amended) The ~~synchronization~~ method of claim 5 wherein said ~~OV~~ extension portion comprises an L-bit cyclic extension portion and said synchronization portion comprises ~~a~~ first and ~~a~~ second N-bit synchronization frames, and wherein said ~~PDF comprises a~~ first term, p1, based on said observed symbol timing ~~offset~~ error ϑ being within the span 1 to N and ~~a~~ said second term, p2, based on said observed symbol timing ~~offset~~ error ϑ being within the span N+1 to N+L.

7. (Currently Amended) The ~~synchronization~~ method of claim 6 wherein said ~~received~~ bit stream has uncorrelated independent identically distributed random signal and noise sequence variables with power of σ_s^2 and σ_n^2, respectively, wherein said OV is denoted x, and wherein said MVU estimator $\varepsilon_{MVU|\vartheta}$ is the conditional expectation of a second moment estimator, said second moment estimator given by

$$\breve{\varepsilon} = \frac{\Im}{2\pi}\ln\left\{\frac{1}{L\sigma_s^2}\sum_{k=\upsilon}^{\vartheta+L-1} x[k]x^*[k+N]\right\}.$$

8. (Currently Amended) The ~~synchronization~~ method of claim 7 wherein said MVU estimator $\varepsilon_{MVU|\vartheta}$ is given by

$$\breve{\varepsilon}_{\text{MVU}|\vartheta} = E\left(\breve{\varepsilon}\,\middle|\, T_1(\chi,\vartheta)\right) = \frac{\Im}{2\pi}\ln E\left\{\frac{1}{L\sigma_s^2}\sum_{k=\vartheta}^{\vartheta+L-1} x[k]x^*[k+N]\, T_1(\chi,\vartheta)\right\}$$

$$= \frac{1}{2\pi}\Im\left\{\ln\frac{T_1(\chi,\vartheta)}{L\sigma_s^2}\right\}$$

where $\Im$ is ~~the~~ <u>an</u> imaginary operator and where

$$T_{1(\chi,\vartheta)} = \begin{cases} \sum_{k=\vartheta}^{L+\vartheta-1} x[k]x^*[k+N] & 1 \le \vartheta \le N \\ \sum_{k=0}^{\vartheta-N-1} x[k]x^*[k+N] + \sum_{k=\vartheta}^{N+L-1} x[k]x^*[k+N] & N+1 \le \vartheta \le N+L \end{cases}$$

9-19. (Canceled)